

## Measuring the Residual Stress by Using New Experimental Methods Depend on the Stress Concentration.

Dr. Sabah Kh. Hussein

Suhad D. Salman

Dr. Kadhim K. Resan

Al-Mustansariya Univ.

الخلاصة :

ان الاجهادات الكامنة تبقى في الجسم في وضع غير مستقر ما لم تتغير الظروف الخارجية وهي تؤثر حتما في اداء المادة او عمر المكون. من المفيد معرفة الاجهادات الكامنة عن قرب و تعدّ الاجهادات الكامنة من الاجهادات التي يصعب التنبؤ بها و هناك طرق عديدة لقياسها منها طريقة الثقب الدائري باستخدام مقاييس الانفعال و طريقة الاشعة السينية وهي طرق تحتاج الى اجهزة دقيقة .

في هذا البحث تم ابتكار طريقة جديدة تم اقتراحها لقياس الاجهادات الكامنة في الملحومات . تلك الطريقة تعتمد على معامل تركيز الاجهاد باستخدام ثقب دائري وعلى ابعاد مختلفة من خط اللحام و لعينات مختلفة (خمس عينات) و بهذه الطريقة يمكن ان تقاس الاجهادات الكامنة في منطقة الثقب . كذلك تم معاملة العينات المختلفة حراريا و قياس الاجهاد عمليا لمعرفة مقدار التخلص من الاجهادات الكامنة و تحت نفس الظروف و لنفس الابعاد و لوحظ انخفاض في قيمة الاجهاد . تم مقارنة النتائج بسلوك توزيع الاجهاد في الملحومات التي تم فحصها بطرق اخرى فكانت النتائج مقبولة .

### Abstract

The residual stress is that which remains in a body that is stationary and at equilibrium with its surroundings. It can be very detrimental to the performance of a material or the life of a component. Alternatively, beneficial residual stresses can be introduced deliberately. Residual stresses are more difficult to predict than the in-experimental methods to service stresses. There are many different measure the residual stress such as hole drilling and x-ray. In this paper , the new method is proposed to measure the residual stress in weldment , this method depends on the stress concentration factor for

circle hole with different distance from weld line for different specimens (five specimens) , the hole is the region of measure the residual stress .Also , the heat treatment is applied for different specimens as same condision and dimention to measure the decrease in the stress .The results are in a good agreement with another method.

**Keywords :** residual stress , stress concentration factor ,welding  
**Introduction**

Residual stresses are those which are not required for an engineering structure to maintain equilibrium with its environment. Although they can have many different origins, residual stresses are always the result of some form of misfit; either between different parts, different regions within the same part, or even different phases within a microstructure<sup>[1]</sup>. Welding residual stresses arise as a consequence of the heterogeneous application of energy and localized fusion. With modern analytical and computational techniques it is often possible to estimate the stresses to which a component is subjected in service. This in itself is not sufficient for the reliable prediction of component performance. Indeed, in many cases where unexpected failure has occurred, this has been due to the presence of residual stresses which have combined with the service stresses to seriously shorten component life. On the other hand, compressive stresses are sometimes introduced deliberately, as in shot peening which is used to improve fatigue resistance. Furthermore, in natural or artificial multiphase materials, residual stresses can arise from differences in thermal expansivity, yield stress, or stiffness. Considerable effort is currently being devoted to the development of basic framework within which residual stresses can be incorporated into design in aerospace, nuclear, and other critical engineering industries<sup>[1]</sup>.

The residual stress in the vicinity of a weld can have a large influence on structural integrity. Here the extent to which the martensite-start temperature of the weld filler metal can be adjusted to mitigate residual stress distributions in ferritic steel welds has been investigated by Francis and *et al*<sup>[2]</sup>

Dai and *et al*<sup>[3]</sup> were study weld residual stresses often approach, or exceed, the yield strength of the material, with serious implications for the integrity of engineering structures. It is not always feasible to measure residual stresses, so integrity assessments often rely heavily on